

WHAT IS CLAIMED IS:

1 Sub 31 1 A system useful for treating an aneurysm in a blood vessel of a
2 mammalian patient, the aneurysm having a neck, a wall, and a cavity, comprising:
3 an elongated¹⁰² catheter having a proximal end, a distal end, and
4 including at least one lumen extending therethrough;
5 a telescoping stretching¹¹⁷ rod positioned in the catheter;
6 at least one steering¹³⁰ pul wire extending distally through the
7 catheter and attached adjacent to the distal end of the catheter;
8 an inflatable¹⁰² member positioned adjacent the catheter distal end;
9 a one-way¹²⁸ valve positioned adjacent the catheter distal end and in
10 fluid communication with the at least one lumen, the one-way valve oriented to
11 permit fluid flow into the catheter lumen;
12 an expandable¹¹⁶ clip releasably attached to the catheter distal end, the
13 expandable¹¹⁶ clip having an unbiased, expanded condition and a biased, collapsed
14 condition;
15 wherein when the expandable¹¹⁶ clip is positioned inside the cavity of
16 an aneurysm and expands, when the inflatable¹¹⁷ member is inflated to substantially
17 seal the neck of the aneurysm from the blood vessel, and when suction is applied
18 through the catheter lumen and through the one-way¹²⁸ valve, the aneurysm wall at
19 least partially collapses on the expanded¹¹⁶ clip.

1 2. A system in accordance with Claim 1, further comprising:
2 a flexible spring positioned adjacent the catheter distal end, the spring 12
3 including a distal end, at least one steering pull wire attached to the catheter 12
4 adjacent to the spring distal end. 12

1 3. A system useful for treating an aneurysm in a blood vessel of a
2 // mammalian patient, the aneurysm having a neck, a wall, and a cavity, comprising:
3 an elongated shaft having a proximal end, a distal end, a longitudinal
4 direction defined between the proximal end and the distal end, and including at
5 least one lumen extending therethrough;
6 * a self-expanding frame positioned at the distal end of the shaft, the frame
7 including a plurality of self-expanding sections and at least one joint, each of the
8 plurality of self-expanding sections having an unbiased, expanded condition and a
9 biased, collapsed condition, each of the plurality of self-expanding sections being
10 foldable about one of the at least one joint when in a biased, collapsed condition.

1 4. A system in accordance with Claim 3, wherein the frame includes a

2 closed distal end, and further comprising:

3 ²¹⁰ a stiffening rod extending through the shaft lumen, the stiffening

4 rod being longitudinally movable in the lumen.

1 5. A system in accordance with Claim 3, wherein the frame sections
2 are detachable from the elongated shaft.

1 6. A system in accordance with Claim 3, wherein the frame sections
2 are radially collapsible.

1 7. A system in accordance with Claim 3, further comprising:
2 a stiffening rod extending through the shaft lumen, the stiffening rod
3 being longitudinally movable in the lumen.

1 8. A catheter useful for accessing a vascular location adjacent to an
2 aneurysm, comprising:
3 a hollow shaft including a proximal end, a distal end, a longitudinal
4 direction defined between the proximal end and the distal end, a port in a distal
5 portion of the shaft, and including at least one lumen extending therethrough;
6 an inflatable member mounted on the shaft adjacent to the shaft distal
7 end, the inflatable member in fluid communication with the shaft at least one
8 lumen, the inflatable member including a proximal end, a distal end, and a wall
9 between the proximal end and the distal end which extends to the shaft so that the
10 shaft port is directly exposed to the exterior of the balloon, the wall delimiting a
11 central working channel.

1 9. A catheter in accordance with Claim 8, further comprising:
2 a longitudinally movable steering wire extending along the shaft;
3 and
4 a deflectable tube mounted at the shaft port, the steering wire
5 attached to the deflectable tube so that when the steering wire is pulled
6 proximally, the deflectable tube deflects laterally.

Fig 10

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1 10. A catheter in accordance with Claim 8, further comprising:
2 a suction port on a distal portion of the shaft directly exposed to the
3 exterior of the balloon; and
4 a suction lumen ²³⁶ extending through the shaft from the shaft proximal end
5 to the suction port.

1 11. A catheter in accordance with Claim 8, further comprising:
2 at least one radiopaque marker mounted immediately adjacent to the
3 central working channel.

1 12. A method of treating an aneurysm in a patient comprising the steps
2 of:

3 advancing a compressed clip through the distal end of a catheter and
4 into the aneurysm;
5 expanding portions of the clip inside the aneurysm;
6 folding a distal segment of the clip on itself together with the
7 adjacent wall of the aneurysm as it becomes dislodged from the stretching bar.

Fig 45, 48
Fig 54, 55

1 13. A method in accordance with Claim 12, further comprising
2 verifying complete occlusion of the neck by injection of contrast agent through
3 multiple side holes just proximal to the balloon and simultaneously applied suction
4 through the one-way valve at the distal end of the catheter until no inflow of the
5 contrast is demonstrated together with deformation of the aneurysm with suction,
6 indicating that the aneurysm neck is completely closed.

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1 14. A method in accordance with Claim 13, further comprising
2 continuing suction with the aneurysm neck completely closed to almost completely
3 collapse the aneurysm by creating a vacuum within the aneurysm.

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1 15. A method in accordance with Claim 12, further comprising
2 measuring transverse and longitudinal dimensions of the aneurysm.

1 16. A method in accordance with Claim 13, further comprising
2 maintaining vacuum within the aneurysm with continuous suction and adhering the 1369
3 aneurysm wall to sides of the clip.

1 17. A method in accordance with Claim 16, further comprising
2 repeating the pulling step until successive segments fold and complete collapse of 137
3 the aneurysm is be achieved.

1 ✓ 18. A method in accordance with Claim 12, further comprising perform
2 a road-mapping arteriogram with measurement of the three dimensional size of the
3 aneurysm and its neck. 18-21 19-2

1 19. A method in accordance with Claim 12, further comprising
2 accessing the aneurysm neck using a steerable catheter. 19-2

1 ✓ 20. A method in accordance with Claim 19, further comprising locking
2 the distal end of the catheter in a position perpendicular to the center of the neck
3 transverse axis.

1 21. A method in accordance with Claim 12, further comprising inflating
2 a balloon mounted on the distal end of a catheter with a diluted contrast to the
3 previously measured size of the neck. *Fy 2* ✓

1 22. A method in accordance with Claim 12, further comprising:
2 pulling a stretching bar to telescope a very distal segment of the
3 stretching bar into the next proximal segment of the stretching bar. *17/65* ✓

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